

REMARKS

The Office Action of January 12, 2007 has been carefully reviewed.

Background

Generally, the present invention relates to a new technique in ultrasonic imaging that differs from conventional B-mode imaging which considers the amplitude of echo signals or Doppler imaging which considers amplitude and center frequency shift of echo signals. This new technique, termed "parametric" ultrasound, analyzes the frequency spectra of the echo signals to deduce parameter values relating to inherent properties of the material such as scatterer size, scatterer spacing; scatterer number density as reflected in the way these properties affect the different frequency components of the echo signal. For example, parametric imaging may look at the slope of the frequency spectrum of the echo signal to determine the extent to which higher frequency components of the echo signal are attenuated differently than lower frequency components of the echo signal.

While it is believed that the term "parametric ultrasound" as used in the claims is understood in the art, the claims are careful to note that the parametric imaging is based on frequency spectra of the echo signal, a characterization that clearly differentiates the present technique from standard B-mode imaging.

Further the claims, as now amended, indicate that the parametric imaging determines inherent or static properties of the material, a characterization that clearly differentiates the present invention from Doppler imaging, which detects velocity or movement of tissue.

Claim Rejection-35 U.S.C. §103

As correctly noted by the Examiner, Jago, like the present invention, discloses an ultrasonic system that combines echo signals from different angles. Applicant's review of Jago, however, indicates that Jago is concerned only with conventional B-mode imaging or Doppler imaging, not parametric imaging. As noted at column 3, lines 50-55 of Jago, Jago considers only amplitude of the echo signal (for B-mode imaging) or Doppler processing for Doppler imaging. Thus, it is believed that the current claims as amended clearly distinguish from Jago by requiring analysis of frequency spectra of the echo signals (not done in B-mode imaging) and the measurement of inherent or static properties of the material (not done with Doppler imaging).

The Examiner does not rely solely on Jago but combines Jago with Oelze. Oelze, in contrast to Jago, does teach parametric ultrasonic measurements but specifically describes measurements taken at only a single angle.

The Applicant believes that a person of ordinary skill in the art, recognizing that Jago teaches conventional B-mode or Doppler ultrasound, would not be led to apply the angular compounding of Jago to the parametric imaging of Oelze for two reasons.

First, it was unknown at this time that small angular differences between ultrasonic acquisitions (necessary for practical application of this technique) could provide the necessary statistical independence of these measurements to improve parametric data. It was equally likely that compounding data at multiple angles might boost the signal and the signal noise comparably, producing no net benefit.

Second, and importantly, it was unknown whether the errors introduced by compounding data taken at different angles and through different structures would overwhelm any benefit from reduced noise in the data. That is, it was unknown whether problems in getting the data from different angles to "line up", would make the data worse.

As noted in paragraph [0007] of the present application, the inventors believe they were the first to determine that relatively small angular differences between acquisitions provide the necessary statistical independence of these measurements for parametric imaging. In fact, the inventors determined that as little as 0.75 degrees of difference in measurements produces sufficient de-correlation with suitably low introduced errors to make this possible. See paragraph [0050] of the present application.

Thus, the applicant believes there is insufficient teaching or motivation in these references or in the art at this time to make the proposed combination between the two different imaging techniques of Jago and Oelze.

Applicant further believes that Oelze, which is specifically directed toward the problems of accurate parametric imaging, teaches away from the angular compounding proposed by the present invention by clearly recognizing at page 3053, second column, first full paragraph, the problems of obtaining accurate parametric data but failing to consider the possibility of obtaining multiple measurements from different angles while instead choosing to try to fit the data to existing models of what the data should look like.

In light of these amendments and remarks it is believed that claims 1-19 and 21-41 are now in condition for allowance and allowances respectfully requested.

Respectfully submitted,

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